Fig. 1

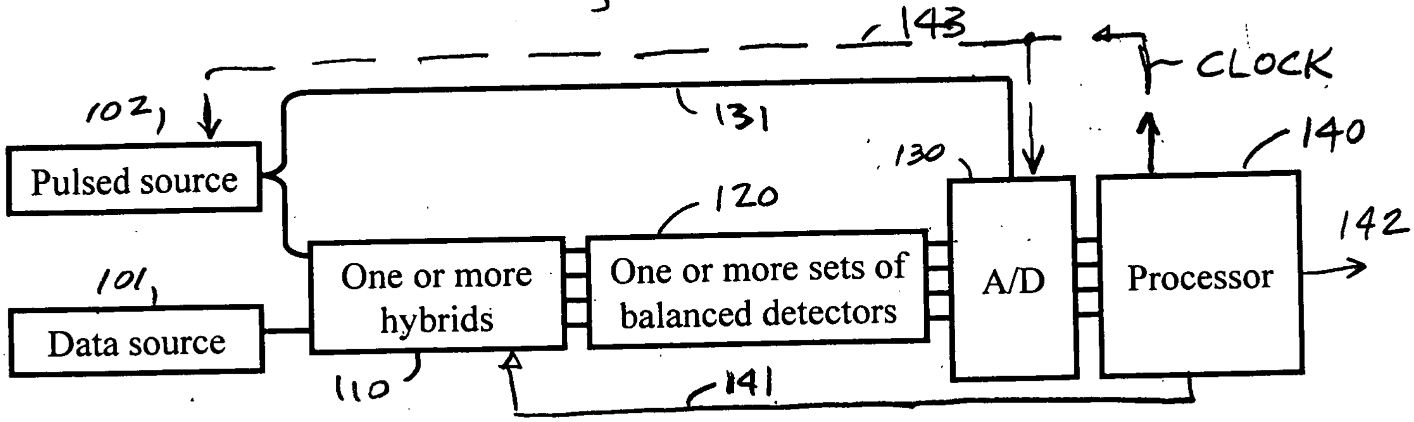

143
CLOCK
102
131
140
130
Pulsed source
120
142
101
One or more hybrids
One or more sets of balanced detectors
A/D
Processor
Data source
110
141

Fig. 2

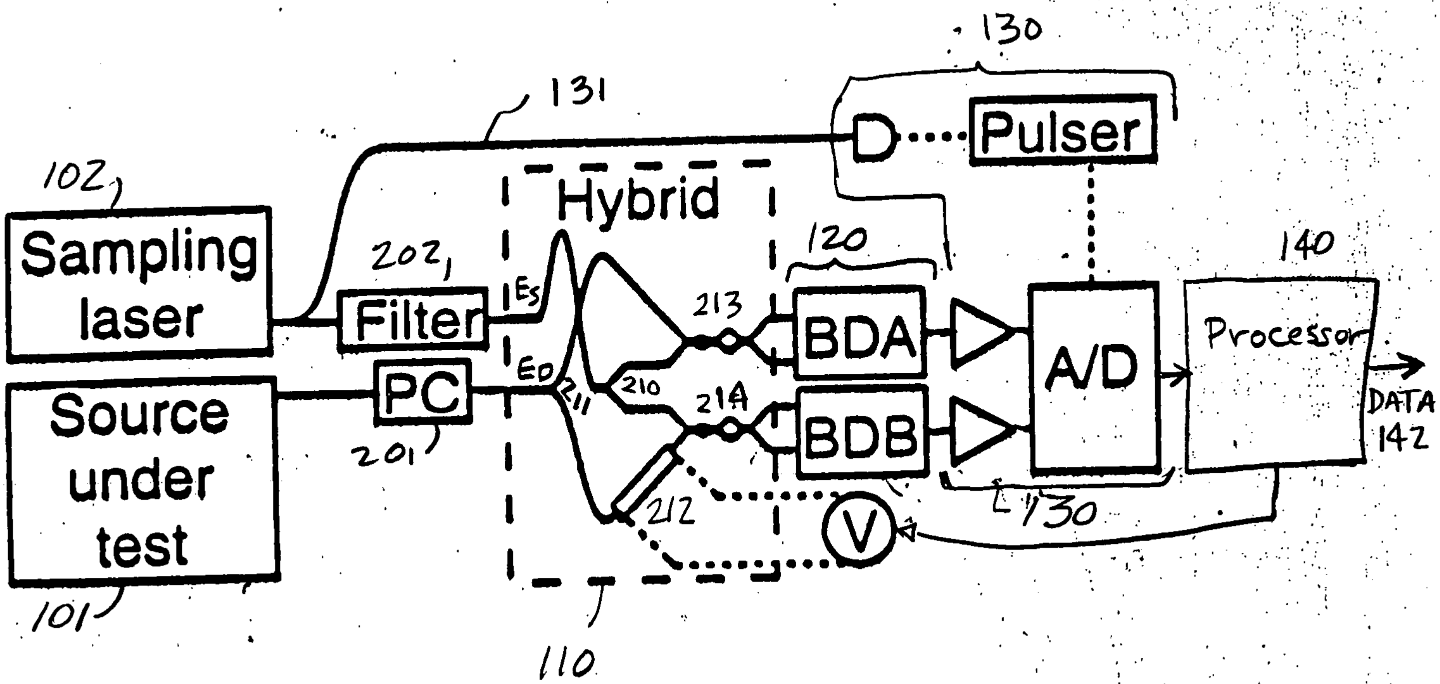

130
131
Pulser
102
Hybrid
Sampling laser
202
120
140
213
Filter
Es
BDA
A/D
Processor
Source under test
PC
ED
211
210
214
BDB
DATA
142
201
212
130
V
101
110

Fig. 3

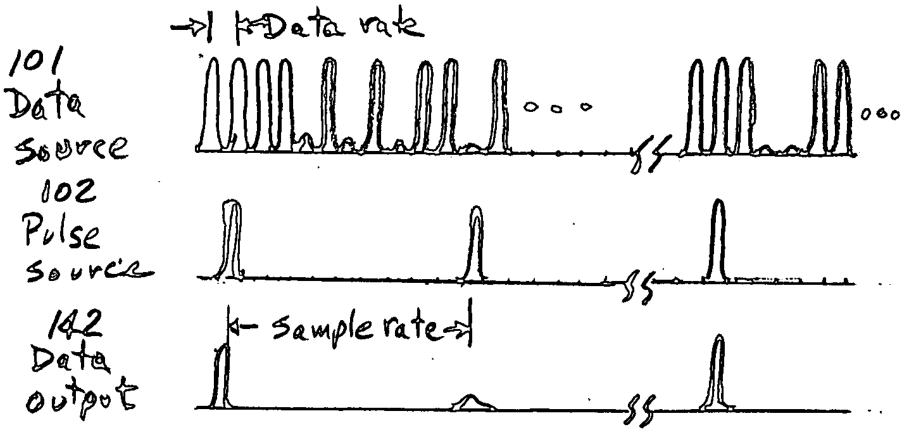
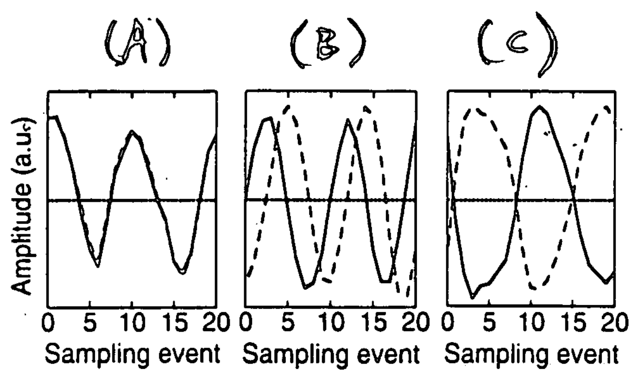

Data rate
101
Data
source
102
Pulse
source
142
Data
output
sample rate

Fig. 5


(A)
(B)
(C)
Amplitude (a.u.)
0 5 10 15 20
Sampling event
0 5 10 15 20
Sampling event
0 5 10 15 20
Sampling event

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140

Fig. 4

A. Numerically scales the two quadratures interference samples S_A and S_B over a large collection of samples by imposing that $\langle S_A \rangle = \langle S_B \rangle = 0$ and $\langle S_A^2 \rangle = \langle S_B^2 \rangle$, where the brackets represent the average value calculated over a large number of samples. This can be achieved by:

- a. Calculating $\langle S_A \rangle$, then calculating $S_A' = S_A - \langle S_A \rangle$ and using it for all subsequent operations.
- b. Calculating $\langle S_B \rangle$, then calculating $S_B' = S_B - \langle S_B \rangle$ and using it for all subsequent operations.
- c. Calculating $\sigma_A'^2 = \langle S_A'^2 \rangle$, then calculating $\sigma_B'^2 = \langle S_B'^2 \rangle$, then defining S_A'' and S_B'' such as $S_A'' = S_A'' / \sigma_A'$ and $S_B'' = S_B'' / \sigma_B'$. Note that other scalings techniques can be performed (what matters in the end is that the standard variation calculated on the two quadratures are identical).

B. Calculates the quantity $2 \langle S_A'' \cdot S_B'' \rangle / (\langle S_A''^2 \rangle + \langle S_B''^2 \rangle)$, which is equal to the cosine of the relative phase between the two quadratures [i.e., $\cos(\varphi_B - \varphi_A)$]. As the relative phase should be equal to either $+\pi/2$ or $-\pi/2$ for optimal operation, its cosine should be equal to 0.

C. Adjusts the relative phase between the two quadratures so that the calculated $2 \langle S_A'' \cdot S_B'' \rangle / (\langle S_A''^2 \rangle + \langle S_B''^2 \rangle)$ is close to zero, within experimental uncertainty. With the hybrid, this operation is performed by the processor 140 adjusting, via phase adjust control signal 141, the voltage applied to the phase-shifter (212 of Fig. 2).

D. The processor then generates a demodulated sample data pulse signal 142 equal to the sum $S_A''^2 + S_B''^2$.

Fig. 6

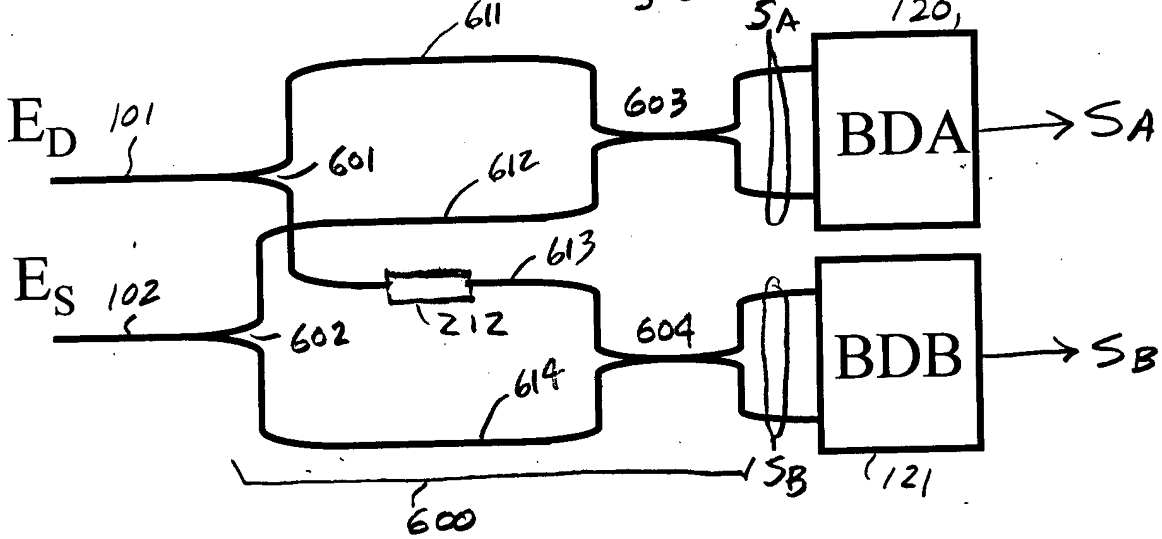

E_D
101
601
611
612
603
S_A
120
BDA
S_A
E_S
102
602
613
212
604
614
BDB
S_B
S_B
121
600

Fig. 7

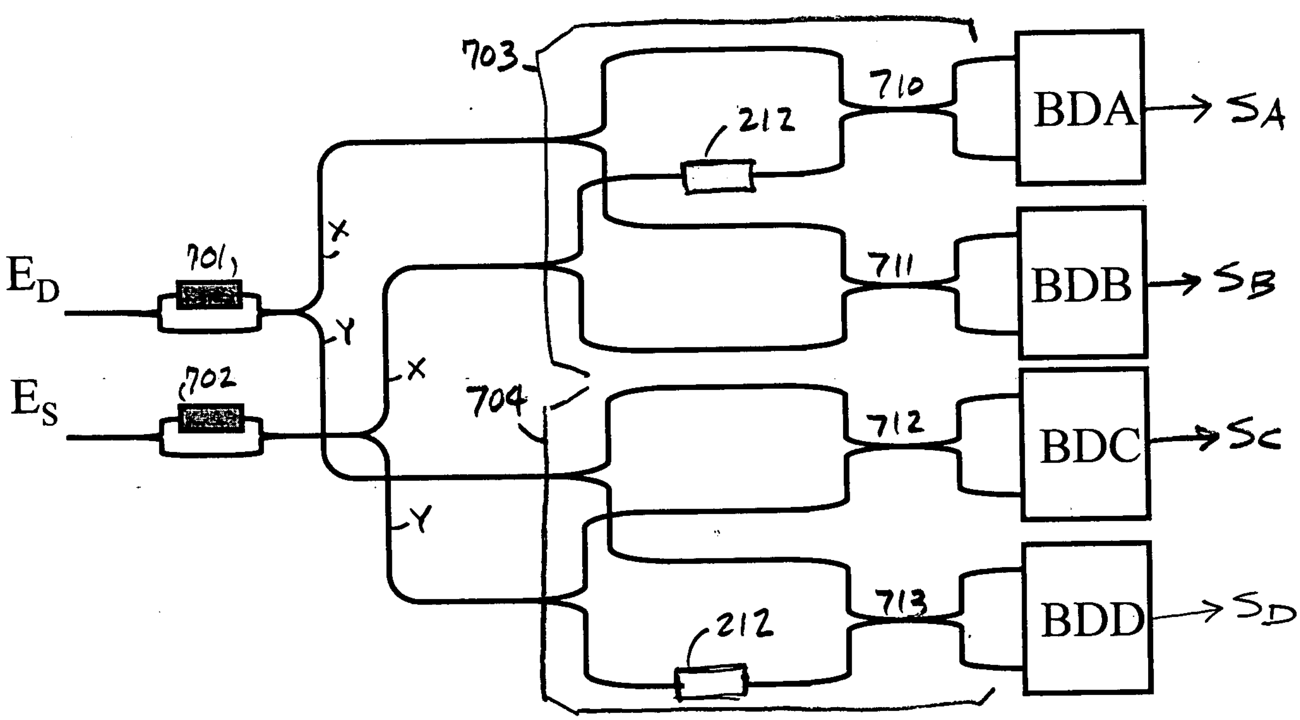

703
710
212
BDA
S_A
E_D
701
X
Y
711
BDB
S_B
E_S
702
X
704
712
BDC
S_C
Y
713
212
BDD
S_D

Fig. 8

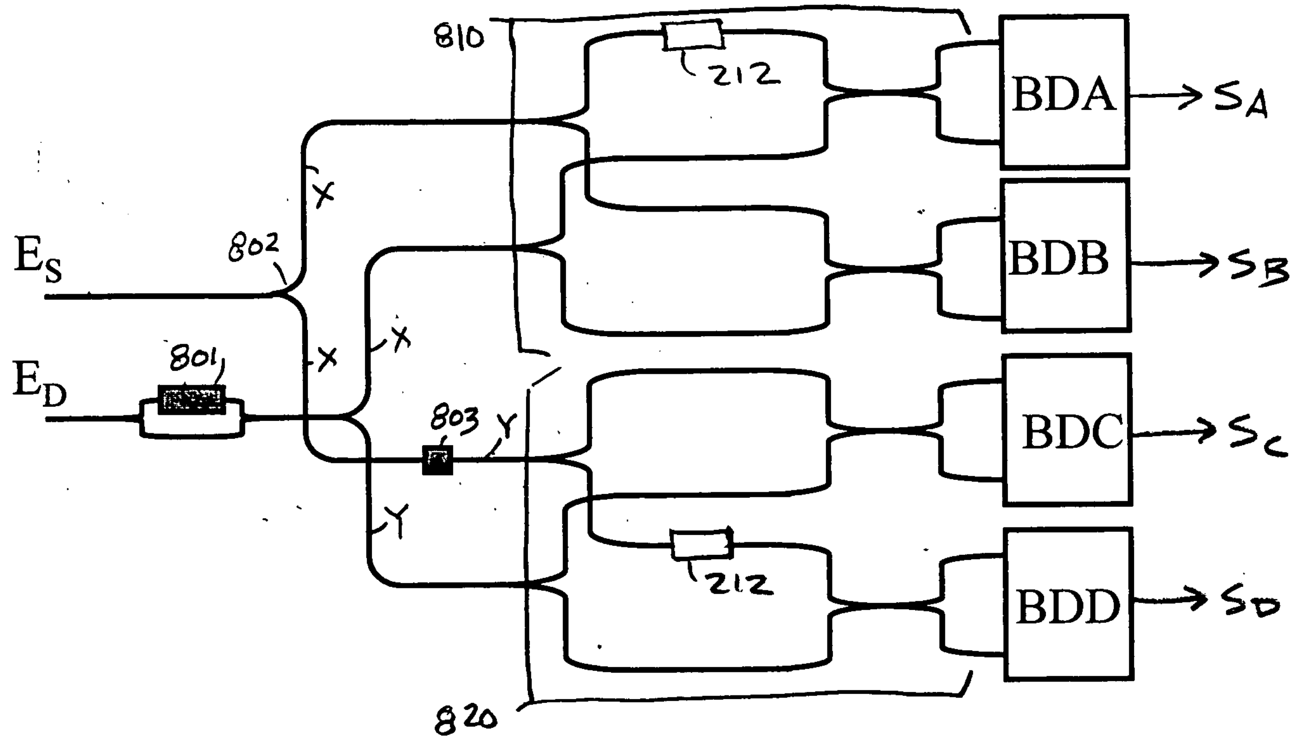

810
212
BDA
S_A
X
E_S
802
BDB
S_B
X
X
801
E_D
BDC
S_C
803
Y
Y
212
BDD
S_D
820

Fig. 9

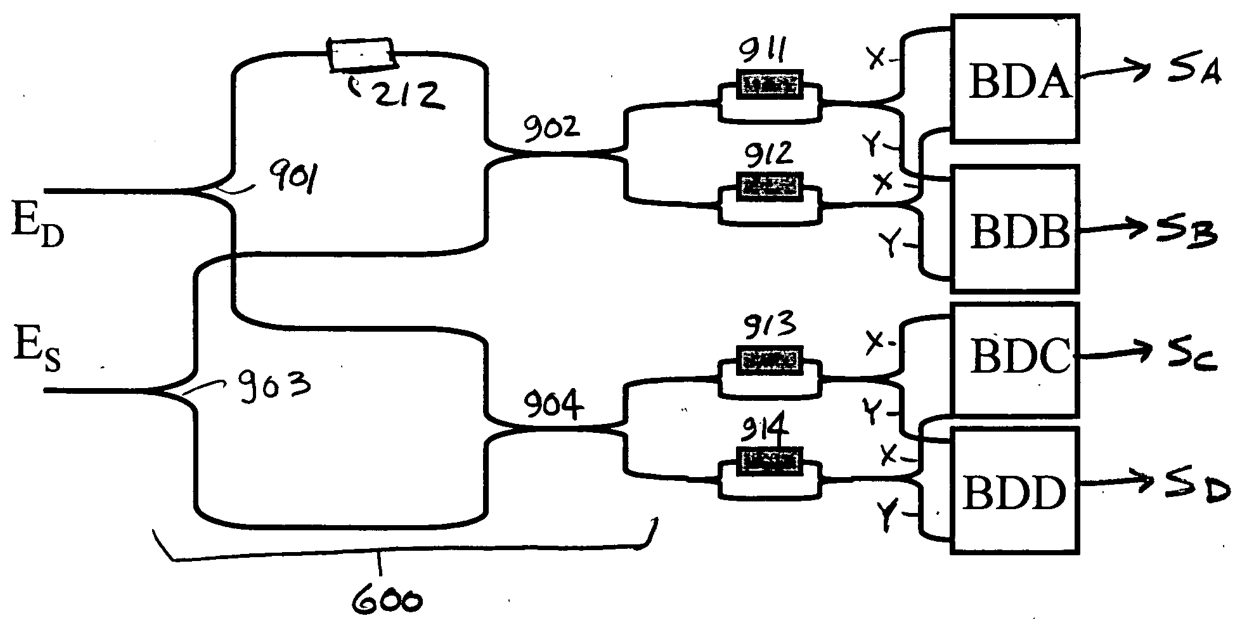
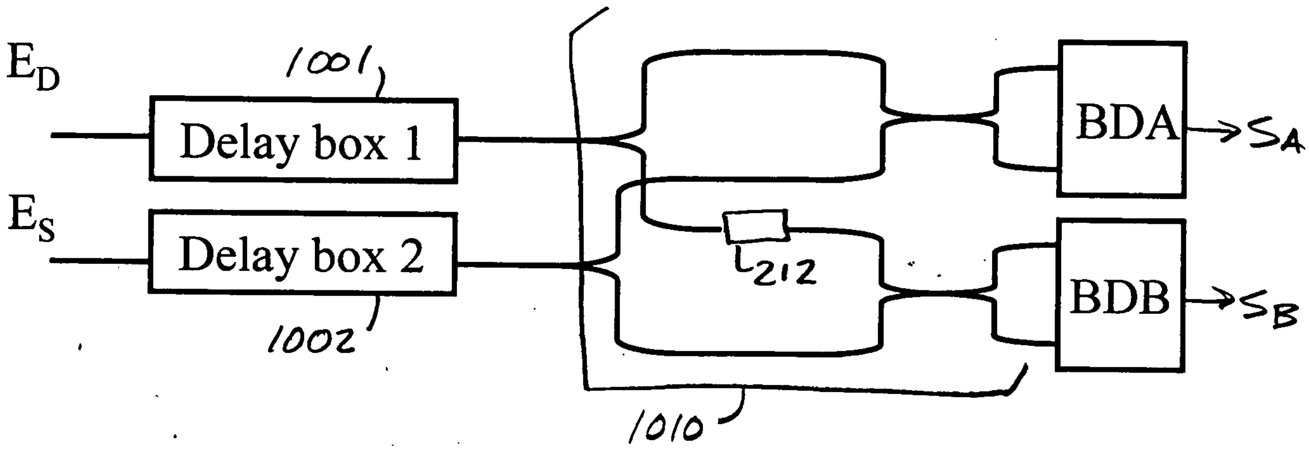
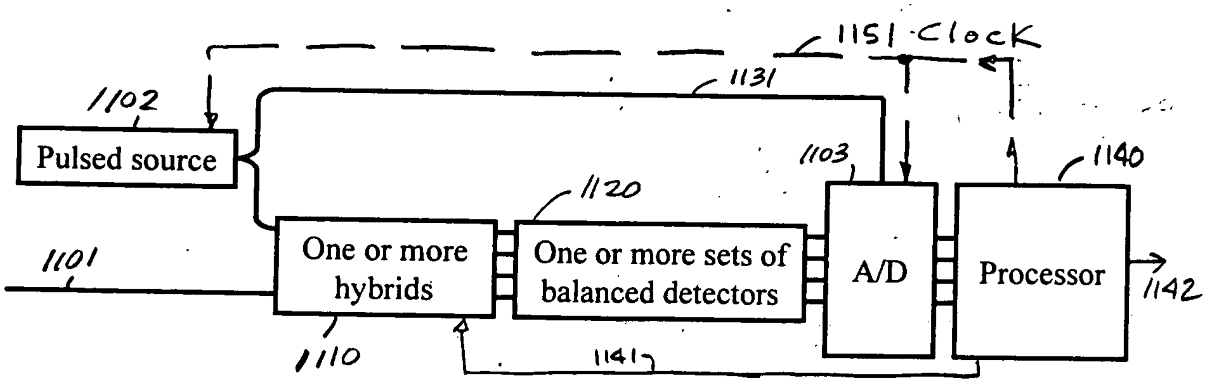

212
911
X
BDA
S_A
902
Y
901
912
X
E_D
BDB
S_B
Y
913
X
BDC
S_C
E_S
903
904
Y
914
X
BDD
S_D
Y
600

Fig. 10



E_D
1001
Delay box 1
E_S
Delay box 2
1002
L_{212}
BDA
S_A
BDB
S_B
1010

Fig. 11



1151 Clock
1131
1102
Pulsed source
1103
1140
1120
1101
One or more hybrids
One or more sets of balanced detectors
A/D
Processor
1142
1110
1141